BEST PRACTICE RECOMMENDATIONS TO SUPPORT KANGAROO CARE IN PRETERM INFANTS IN THE NICU

By

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Abstract

This thesis investigates credible medical and nursing journals on the topics of kangaroo care in preterm infants in a neonatal intensive care unit setting. These research articles focused on interventions and recommendations that maximize the benefits of kangaroo care in this targeted population. Research and education on this topic is much less utilized compared to kangaroo care in full-term infants. Implementation of kangaroo care in the clinical setting is slow-moving, during its transition state from the literature to execution (Ludington-Hoe, 2011). Many variations of kangaroo care are explored in these research articles, thus there is great room for interpretation into best practice recommendations. The purpose of this thesis is to create best practice recommendation to support kangaroo care in the NICU, and promote utilization of such recommendations. Along with various interventions, many outcomes and benefits were analyzed in these articles as well. The proven benefits and positive outcomes for the use of kangaroo care have been momentous and have a potential to play a crucial role in the clinical setting. The culmination of this paper will establish best practice recommendations, an implementation plan for an educational bulletin board in a kangaroo-a-thon, and an evaluation of the participation in the kangaroo-a-thon.

CHAPTER 1

Introduction

Statement of Purpose

The purpose of this thesis is to create evidence-based, best practice recommendations to support the implementation of kangaroo care in preterm infants in the Neonatal Intensive Care Unit (NICU) setting. The recommendations in this thesis are supported by evidence-based research articles that examine different variations and uses of kangaroo care to ultimately elicit positive results in preterm infants. The background of the issue and significance of the problem will allow for education and a clear direction of purpose to nurses and families that will be eligible to implement it in the clinical setting. Additionally, the research articles presented will support the multiple benefits of care, followed by best practice recommendations with the overall intention of improving the total amount of nurses and mothers utilizing kangaroo care in preterm infants in the NICU.

Background of the Issue

A preterm infant is any infant born before 37 weeks of gestation (Durham & Chapman, 2014). Preterm infants often have multiple health issues, including the inability to regulate body heat, respiratory distress, a compromised immune system, cardiovascular system disorders, as well as many others (Cho et al., 2016). Due to the complications that they experience, it is common for preterm infants to spend the beginning of their life in a NICU. Unfortunately, in the NICU, there are detrimental amounts of exposure to stress-provoking conditions such as invasive procedures, excessive noise, and excessive light stimulations (Lyngstad, Tandberg, Storm, Ekeberg, & Moen, 2014). It has been shown that unneeded exposure to stress in infancy can cause long-term health problems. Stress and pain that is unalleviated during infancy has been

proven to be associated with behavioral and physiologic negative outcomes during adulthood (Lyngstad et al., 2014). Kangaroo care (KC) has been proven to be an effective intervention for improving these potential negative outcomes (WHO, 2017).

Kangaroo care, often used interchangeably with skin-to-skin contact (SSC), is named so for its similar positioning between mother and baby kangaroos. It is defined as a vertically positioned cradle where the infant is positioned with as much direct skin-to-skin contact to the mother as possible, most commonly seen chest-to-chest between the mother's breasts (Lyngstad et al., 2014). According to Hake-Brooks & Anderson (2008), kangaroo care is under-utilized in developed countries because of hospitals' easy accessibility to incubators, as well as the practice is not as well known, and thus not as accepted. The purpose of this literature review is to further investigate the various benefits that kangaroo care has on preterm infants and find evidence to build recommendations in order to support wider implementation in the NICU setting.

Significance of the Problem

Annually there are around 15 million infants born prematurely (World Health Organization [WHO], 2017). This statistic equates to around one in ten babies that are born before a gestational age of 37 weeks. This occurrence is a significant problem globally because complications related to prematurity are the leading cause of death in children under five years old, with an estimated number of around one million deaths annually around the world. Of these one million deaths, around three quarters of them could have been prevented with interventions such as kangaroo care. Children born prematurely that do survive past five years, are prone to multiple psychological and physiological complications throughout their life that can follow them into adolescence and adulthood (WHO, 2017). Premature birth survivors have also been proven to display a lower level of motor and cognitive skill than full-term infants, partly

attributed to by the amount of painful procedures they undergo during hospitalization (Teckenberg-Jansson, Huotilainen, Pölkki, Lipsanen, & Järvenpää, 2011).

Infants who develop current or future health problems related to prematurity can end up accumulating high costs for both their families and society. (March of Dimes [MOD], 2015). It is estimated to cost society approximately $611 million for early intervention services, $1.1 billion for special education services, and $5.7 billion in lost work and pay for people born prematurely (MOD, 2015). There are also costs associated with the Supplemental Security Income, which is a program that supplements disabled adults, many of whom were born prematurely (MOD, 2015). An overall financial goal in implementing KC is to reduce monetary burdens by preventing further complications of prematurity. The ability of KC to improve the quality of life of preterm infants will substantially decrease negative health outcomes and mortality in their future (Lawn et al., 2010). Kangaroo care has been proven to decrease stress in infants, thus positively influencing short and long-term outcomes as well as preventing long-term sequelae to stress (Lyngstad et al., 2014). Long-term effects proven to result from KC include physiological and behavioral stability, as well as an improved growth and development, each of which can contribute to decreasing future healthcare costs (Cho et al., 2016). There have been studies displaying the association between the use of KC with reduced mortality, reduced length of hospital stay, reduced incidence of hypothermia, increased weight gain, increased breastfeeding, improved maternal-infant bonding and maternal satisfaction (Conde-Agudelo, Belizan, & Diaz-Rossello, 2011). A 10 year longitudinal study proved that children who received kangaroo care as premature infants showed "attenuated stress response, more mature autonomic functioning, organized sleep, better cognitive control, and more reciprocal mother-child relationship" when compared to infants who did not receive kangaroo care (Feldman, Rosenthal, & Eidelman,

2014). Long-term and short term benefits will ideally allow infants to leave the NICU sooner; thus relieving monetary load, overcrowding, and nursing burn out in NICU's.

Summary

The goal of this thesis is to provide best practice recommendations to increase kangaroo care in preterm infants in NICU settings. Ideally, with proper training and education, nurses will be able to implement kangaroo care practice in the clinical setting and further educate fellow nurses and parents. Kangaroo care for full-term infants has been recommended by organizations such as the American Academy of Pediatrics, the American Heart Association, the American College of Obstetricians and Gynecologists, Neonatal Nurses, and many more (Ludington-Hoe, 2011). Comparably, the integration of kangaroo care in pre-term infants has had similar support and recommendations; however, implementation in the clinical setting has been hindered partly by the lack of education provided to the estimated 20,000 neonatal nurses and 112,000 labor and delivery nurses (Ludington-Hoe, 2011). The purpose of this thesis is to create evidence-based best practice recommendations that will be available to educate nurses and families so that kangaroo care can become a standard intervention performed on preterm infants in NICU's.

CHAPTER 2

Review of Literature

The evidence-based research articles in this thesis were obtained through searches on CINAHL and PubMed. The PICOT question utilized was, "What are the effects of kangaroo care on preterm infants in a neonatal intensive care unit, when compared to no kangaroo care?" Research study dates were set between 2008 and 2018. Search terms used by the student to find scholarly articles were "kangaroo care", "NICU", "skin to skin", and "preterm". No filters were used in the student's database search. From the literature search, eleven articles were chosen to be included, based on the variety of interventions and the level of evidence they offered. The results from these articles will be used in a literature review to generate best practice recommendations to support the implementation of maternal kangaroo care with preterm infants in NICU's.

Intervention of Kangaroo Care on Mortality and Morbidity

Lawn et al. (2010), published a meta-analysis review to review and estimate the effect of kangaroo mother care (KMC) on neonatal mortality related to complications from preterm birth. The authors did systematic searches using the databases: Cochrane Libraries, PubMed, LILACS< African Medicus, EMRO, and all World Health Organization Regional Databases (Lawn et al., 2010). They included work in any language. The key words used to find their research articles were: "kangaroo mother care", "kangaroo care", and "Skin to skin care*".* The PICO question format was utilized to find articles, with a search date range from 1968 to September 8, 2009. The *population* of interest were neonates, the *intervention* was KMC, the *comparison* population was conventional care, and the *outcomes* of interest were (i) neonatal mortality due to complications of preterm birth; and (ii) serious neonatal morbidity related to

prematurity (i.e. respiratory distress, pneumonia, septicemia, etc.). Search results uncovered 6,127 articles, which were decreased to 524 articles that matched the outcomes of interest. From those 524, 15 studies were chosen, nine being randomized controlled trials and six being observational studies (Lawn et al., 2010).

In the final meta-analysis looking at mortality outcomes in randomized controlled trials, three studies from low/middle-income countries were included (Lawn et al., 2010). The studies were all of moderate or high quality. The meta-analysis found that "KMC was associated with a major reduction in neonatal death for babies <2000 g (RR 0.49, 95% CI 0.29-082, I_2 = 0, 3 studies, 988 infants)" (p. i148). Morbidity as an outcome in randomized controlled trials had five trials that met inclusion criteria and were used in the meta-analysis. They were all of moderate to high quality and reported reductions in severe morbidity. It was concluded from this meta-analysis that "KMC was associated with a reduction in serious neonatal morbidity (RR = 0.34, 95% CI 0.17-0.65, five studies, 1520 babies)" (p. i148). Another meta-analysis looking at the outcome of mortality was conducted using three observational studies. The meta-analysis showed that there was a reduction in neonatal mortality in babies that weight less than 2000 g (RR 0.68, 95% CI 0.58-0.79, three studies, 8257 infants) (Lawn et al., 2010).

This meta-analysis showed that KMC did have a substantial effect on decreasing neonatal mortality and was also effective in reducing morbidity. With the information recovered, the authors indicated that there was enough evidence to confidently recommend the routine use of KMC in clinics with stable babies that were born weighing at least 2000 grams (Lawn et al., 2010). Lawn et al. (2010), stated, "Up to half a million neonatal deaths due to preterm birth complications could be prevented each year if this intervention were implemented at scale" (p. i153).

Intervention of Kangaroo Care for Pain

The purpose of this randomized controlled, double masked, crossover trial was to determine if Kangaroo Mother Care (KMC) in small duration was effective in decreasing pain in preterm neonates during a heel prick (Nimbalkar, Chaudhary, Gadhavi, & Phatak, 2013). The trial involved 50 neonates between the gestational ages of 32 weeks to 36 weeks and 6 days, weighing less than 2500 grams, in a NICU in Karamsad, India. All of the participants were within 10 days of birth. Using an online software randomizer, infants were randomly placed to be in either the KMC intervention group, or the control group. Infants in the KMC intervention group were held in correct kangaroo positioning for 15 minutes before, throughout the procedure, and 15 minutes after the heel prick. Positioning comprised of the infant being held upright at an angle of 60°, between the mother's breasts, with a blanket placed over the infant's back. In the control group, the infants were kept in a prone position, and swaddled in a blanket for 15 minutes before the procedure. Two nurses performed the heel pricks to ensure the procedure was consistent. Analyses of the infants' videos were done by two trained people who were blinded to the purpose of the study using the Premature Infant Pain Profile (PIPP) as a guideline. The PIPP analyzed: heart rate, SpO2, brow bulge, behavior, eyes squeezed shut, nasolabial furrow, and gestational age (Nimbalkar et al., 2013).

The results of the study were completed with full data from 47 babies, while three babies had missing data (Nimbalkar et al., 2013). The average PIPP score for infants receiving KMC was 5.38, compared to the average score of 10.23 in infants who did not receive KMC. These results were highly statistically significant, as well as clinically significant ($p < 0.0001$, 95% Confidence interval (CI) of the difference: 3.372, 6.331) (Nibalkar et al., 2013). Every one of the infants in the KMC group had lower PIPP scores than the infants in the control group. Heart rates

were significantly lower with KMC care than without it. Facial actions and behaviors were also better in the KMC group when compared to the control group. All of this data was statistically and clinically significant. There was an Inter-rater agreement for PIPP, at 0.84. A weakness in this study was that it used a 26-gauge needle for the heel stick because it was common in India, even though an automated lancet is preferred; thus, it lacked generalizability in places other than India (Nimbalkar et al., 2013). Some strengths of the study were that it was consistent with two previous studies that tested similar research questions, and there were no conflicts of interest. Overall, it was concluded that a short duration of KMC was successful and should be utilized and promoted as a non-pharmacologic, cost effective intervention to decrease pain in preterm infants during painful procedures (Nibalkar et al., 2013).

Intervention of Kangaroo Care for Stress

Lyngstad et al. (2014), published a randomized crossover pilot study that investigated whether diaper changes caused stress in preterm infants, as well as whether or not skin-to-skin contact decreased that stress. There were 19 preterm infants included in this study with gestational ages between 28 to 34 weeks, all hospitalized in the Drammen Hospital Norway's NICU. The randomized, equal assignment to either the skin-to-skin group or control group was determined sequentially in sealed envelopes. Stress during the diaper changes was measured by the MED-Storm's Skin Conductance Algesimeter (SCA) monitors. The SCA monitor measured bursts of sympathetic innervation, displayed as skin conduction (SC) peaks per second. Overall, it was a non-invasive tool that simply required placement of electrodes on the infants' feet. Changes in SC peaks per second were evidence of emotional sweating, and were mediated through the cholinergic muscarinic receptors in the infant. Stress in the infants was measured by heart rate (HR) and oxygen saturation (SpO2) levels before, during, and after the diaper change.

All diaper changes were performed by the same nurse, following standard NICU procedure in order to ensure consistency. The infants in the control group were set in either an incubator or bed, and positioned side-wise while their mothers held their hands on their body while comforting them in a soothing voice. The infants in the skin-to-skin group were put into a lateral kangaroo position, while their mothers held their hands on their head and body, and comforted them in a soothing voice (Lyngstad et al., 2014).

The results showed that diaper changes were in fact a stressful event to preterm infants, as evidence by the increased SC peaks per second from before to during the procedure (Lyngstad et al., 2014). The pertinent results in this study found that there was a statistically significant difference in SC peaks per second between the skin-to-skin and control group during their diaper changes. There was a lower number of peaks in the skin-to-skin group, (mean paired difference -0.089, 95% CI -0.168 to -0.011, $p = 0.028$) (Lyngstad et al., 2014). These results concluded that there were significant decreases in stress for infants when changed skin-to-skin, versus when infants were changed in a bed or incubator (Lyngstad et al., 2014). A weakness was the very small sample size, although it should be taken into account that this was a pilot study. A strength to this study was the equality in gender demographics of the infants. A further strength was that it created a good foundation for further research, and may have clinical implications. In conclusion, this article supports the idea that skin-to-skin care reduces stress in non-painful procedures like diaper changes in preterm infants (Lyngstad et al., 2014).

Intervention of Kangaroo Care for Maternal and Infant Stability

Cho et al. (2016), aimed to determine the effects of kangaroo care on physiological functions in preterm infants, level of maternal-infant attachment, and level of maternal stress. There were 40 infants that were non-randomly assigned to be in either the control group or the

experimental group that received kangaroo care at a general hospital in Seoul, South Korea. The physiological effects that were measured in this experiment were weight, heart rate, respiratory rate, oxygenation saturation, and body temperature. All preterm infants had a gestational age at or above 33 weeks, as it classified them as stable and less vulnerable to health problems. Physiological measurements for the control group were taken at a set-designated time of 1500, and measurements for the experimental group were taken five minutes before and after the intervention. Pre-maternal-infant attachment level was determined by a 24-item questionnaire. Pre-maternal stress level was determined by a 20-item Parental Stress Scale questionnaire. Kangaroo care was performed three times per week, a total of 10 times, each in 30-minute sessions. Mothers held their infants on their chest at a 60° vertical position, while holding their bottom and maintaining contact with their head and neck (Cho et al., 2016).

The results of the study showed significant differences in respiratory rates between the groups ($F = 5.70$, $p = .020$) (Cho et al., 2016). The respiratory rate was significantly lower in the experimental group than the control group, thus contributing to respiratory stability. Respiratory rates were the only significant finding among physiological functions. However, results did show improvements for heart rate, SpO2, body temperature, and weight gain in the experimental group. The study also found increases in maternal-infant attachment in pre-test to post-test ($F = 28.881$, $p < .001$) (Cho et al., 2016). These results indicated that kangaroo care had a positive influence on maternal-infant attachment. Results also showed that kangaroo care was effective in reducing maternal stress ($F = 47.320$, $p < .001$); however, results were not considered significant (Cho et al., 2016). Weaknesses in the study were the limitations of a small sample size and that the participants were not randomly assigned to groups. A strength to the study was that results were congruent with previous studies supporting similar benefits of KC. In conclusion, this study

revealed that kangaroo care created positive effects on stabilizing the infants' breathing, as well as creating favorable benefits for the mothers (Cho et al., 2016).

Arnon et al. (2014), created a prospective randomized, within-subject, crossover, repeated-measures study. This study investigated whether or not kangaroo care (KC) and maternal singing benefited preterm infants alone, as well as combined (Arnon et al., 2014). The study looked at the effect of the interventions on infant autonomic stability, as well as maternal anxiety levels. Results were concluded based on infant and maternal measurements of heart rate, respiratory rate, oxygen saturation, and heart rate variability (HRV) power. HRV was the main factor used to determine autonomic nervous system stability in the infants, measured by low frequency (LF) power and high frequency (HF) power. Maternal anxiety was measured using the state-trait anxiety inventory form Y scale. There were a total of 86 mother-infant dyads used in the study. Infants were all stable and had a gestational age of 32-36 weeks. Over a two day period, dyads alternated therapies of either kangaroo care alone or kangaroo care with maternal singing. However, all dyads began and ended each of their alternating assigned therapy with 10 minutes of kangaroo care alone. During the KC, mothers assumed standard kangaroo care positioning. If mothers were singing, they were asked to sing with a repetitive, soothing, soft, simple and slow tempo. They were also asked to keep their sound level between 60-70 dB. Physiological measurements were taken from baseline levels, during singing, and during the recovery phases of the study. Maternal and infant heart rates, oxygen saturations, and respiratory rates were recorded every two minutes throughout the intervention (Arnon et al., 2014).

Results showed that compared to KC by itself, KC with maternal live singing created a significantly beneficial decrease in maternal anxiety: 56.2 ± 10.8 before and 42.8 ± 8 after KC alone ($p = 0.09$) vs 50.6 ± 12.3 before and 26.4 ± 8.2 after KC with singing ($p = 0.04$) (Arnon et

al., 2014). Results also revealed that the LF/HF ratio was lower during KC with singing and recovery phases than KC by itself ($p = 0.04$). The ratio was also significantly lower during singing and recovery phases when compared to the baseline ($p = 0.0$ and $p = 0.01$). There were no statistical or clinical differences in heart rate, oxygen saturation, and respiratory rate in any of the study phases. However, this is most likely attributed to the fact that all of the infants were being held in KC, thus adding maternal singing had a significant impact only on autonomic stability as evidenced by the change in LF/HF HRV ratio. Overall, this study concluded that the combination of kangaroo care and maternal live singing was associated in an improvement of autonomic stability in infants, along with a decrease in maternal anxiety (Arnon et al., 2014).

Teckenberg-Jansson et al. (2011), conducted a repeated measures analysis to better determine what the influence of music therapy (MT) combined with kangaroo care (KC) as a dual treatment (DT) would be on physiological responses vs the influence of KC alone. The study included 61 stable infants born between 24 and 36 week gestation, in Helsinki University Central Hospital, Finland (Teckenberg-Jansson, 2011). The authors conducted a literature review on KC on premature infants. Major findings from this included: reduced pain responses, more sleep, shorter recovery time, and more weight gain. They also conducted a literature review on MT, which showed results of: fewer occurrences of oximeter alarms, decreased blood pressure, deceased heart rate, increased oxygen saturation; as well as positive outcomes on stress behaviors, weight gain, and duration of hospitalization. Infants alternated between receiving standard KC and dual therapy (DT), which consisted of both music therapy and kangaroo care simultaneously. Music therapy was usually 20 minutes long and performed by a trained music therapist using a lyre and a female voice, as well as individualized to each infant. Physiological measurements were taken 10 minutes to 2 hours before therapy, when therapy started, 10

minutes after starting therapy, and 10 minutes to 2 hours after ending therapy. Parents also filled out a qualitative questionnaire after therapy to describe their experiences. Therapy was given every Monday, Tuesday, and Thursday in an alternation pattern until discharge. Overall, 400 therapy sessions were conducted in the study (Teckenberg-Jansson et al., 2011).

Results found that dual therapy caused a decrease in both heart rate and respirations. DT also caused an increase in oxygen saturation. Infant's reactions were described to be visible in their facial expressions and eye movements. Infants were described to try and open their eyes and sometimes smile when music started. Some infants were reported to start crying when music stopped, and stop when the music was resumed. Parents of infants mostly saw noticeable effects from the DT (46 out of 49 returned questionnaires). The most common complaint however, was the difficulty in accommodating to the schedule with the music therapist vs being able to implement kangaroo care by itself on their own time. It was shown that overall parents were usually calmed and content while experiencing the dual therapy. No significant difference was found on growth of the infant and the length of their stay in the hospital. Overall, the most significant results were the rapid, positive effects on pulse and blood pressure. There were limitations to this study, including: broad time for measurements of physiological parameters before and after therapy, variance in time of actual therapy, lack of control group, and lac of randomization (Teckenberg-Jansson et al., 2011). Future research should be added to this study, however limitations should be corrected.

Intervention of Kangaroo Care for Neurological Development

Carbasse et al. (2013), designed a prospective observational study that looked to determine the safety and effectiveness of kangaroo care to support neurodevelopment in vulnerable preterm infants. It subsequently investigated what the effects of the kangaroo care

were. There was a total of 96 preterm infants with an average gestational age of 28 weeks, an average postnatal age of 12 days, and an average weight of the infants as 1070 grams. All infants were admitted to the NICU in the University Hospital of Strasbourg. An important characteristic to consider is that 92 of the 96 infants had a central venous catheter in situ. During the study, the infants were continuously monitored by several nurses on staff and parameters were measured 5 different times, at pre-set intervals that were consistent among all infants. The intervention consisted of the infants being placed in a diaper, placed into kangaroo position on their mother and then covered with a blanket (Carbasse et al., 2013). Infants were continuously monitored and during the SSC their physiological vital signs, transcutaneous partial pressure of carbon dioxide, and adverse events like bradycardias and desaturations were recorded. There were statistically significant changes found for most of the physiological parameters being measured (Carbasse et al., 2013).

There was a significant decrease in heart rate, which pointed the infant towards a more stable status (Carbasse et al., 2013). There was also a significant decrease in oxygen requirements and a significant increase in oxygen saturation. A significant temporary and moderate decrease in the average axillary temperature was found after the infant was transferred from the bed to the mother. A major finding in this study showed that kangaroo care is just as safe and effect in very-low weight preterm infants, as in more stable preterm infants. Conclusions were made that kangaroo care promotes physiological stability and significantly decrease oxygen demand, making it clinically significant (Carbasse et al., 2013). The weakness in limitation included the inability to exclude selection bias, due to the fact that it was an observational study. There is also no way to rule out the effect of subjective reporting on the outcomes of physiological data taken by the nurses. A strength of this study was the big sample

size. In conclusion, skin-to-skin contact is safe and effective for vulnerable preterm infants, and can help contribute to their improvement in neurodevelopment (Carbasse et al., 2013).

Intervention of Kangaroo Care for Cardiorespiratory Parameters

Mitchell, Yates, Williams, & Hall (2013), created a randomized, controlled trial to look at the different cardiorespiratory effects that kangaroo care (KC) had on preterm infants that were 27-30 week gestation age, less than 1000 g, and on either CPAP or nasal cannular oxygen. There were 38 infants included and randomly selected to either experience daily kangaroo care, or regular incubator care. The kangaroo care consisted of performing kangaroo care for two hours a day, it started on their fifth day of life and continued for five days straight. Parents were sat in a rocking chair in private rooms with their infants wearing knitted caps and covered across the back in a blanket. Axillary temperatures were taken every 30 minutes to confirm stability, as well as continuous monitoring of heart rate, respirations, and SpO2. Incubator infants were in the incubator for 24 hours, aside from the option to allow 15 minutes of kangaroo care a day for parents who requested it. Every infant was also receiving 6 mg/kg of caffeine and was being fed every three hours. Outcomes were measured based on physiological parameters as well as bradycardia (<80) and desaturation events (<80%) (Mitchell et al., 2013).

Results showed a significant effect of the treatment group on bradycardia ($p = 0.02$) and oxygen desaturation ($p = 0.0015$) (Mitchell et al., 2013). There were significant differences in negative events for the infants in the KC group, depending on whether or not they were being held or in the incubator. Results showed that there were significantly less bradycardia events ($p = 0.046$) and oxygen desaturation events (0.017) for infants in the KC group when they were being held. Results also showed no changes in temperature stability, loss of IV access, feeding intolerance, or need for enhanced respiratory support during the kangaroo care. There were also

no differences between kangaroo care and incubator care when it came to infection rates (Mitchell et al., 2013). Limitations of the study include the fact that it was impossible for every infant to always be under direct observation for the continuous five days as well as there was a small sample size. However, it was concluded that KC positioning led to a decrease in bradycardic and desaturation events in preterms and should be promoted (Mitchell et al., 2013).

Intervention of Kangaroo Care for Sleep

Bastani, Rajai, Farst, & Als (2017), conducted a randomized controlled trial that compared in-arms-holding (IAH) and kangaroo care (KC) on different levels of sleep and wake states in preterm infants. There were 70 infants with a gestational age of 32-37 weeks recruited and randomly assigned for this study that took place in a NICU in Tehran, Iran. The study consisted of a pre-intervention phase, an intervention phase, and a post-intervention phase. The pre-intervention phase was the initial 20-minute observation period before the interventions began. For the intervention phase, the KC group infants were placed on their mother's bare chests wearing only a diaper at a diagonal angle. The infants' heads were set near their mother's hearts and a blanket was gently wrapped around them. In the IAH group during the intervention phase, infants wore only a diaper and were gently wrapped in a soft blanket and then put into their mother's cradled arms. Both interventions facilitated eye contact and lasted for 70 minutes. The Newborn Individualized Developmental Care and Assessment Program assessed sleep and wake states in the following six levels: deep sleep, light sleep, drowsy, quietly awake and/or alert, actively awake and aroused, and highly aroused and agitated/crying. Physiological parameters were monitored throughout the whole study, and included respiratory rate, oxygen saturation, and heart rate (Bastani et al., 2017).

The results showed that the deep sleep in the KC group increased to 23.08 ± 4.22 and the IAH group increased to 5.31 ± 5.88 (Bastani et al., 2017). Both groups increased their time in deep sleep, however, the KC group increased their time more than the IAH group. There was a significant change between the two groups, based on average scores of deep sleep throughout the three phases ($F = 184.05$, $p = .001$) (Bastani et al., 2017). The IAH group experienced more time in light sleep, drowsy state ($p < .001$), and the actively awake state ($p = .02$). The KC group showed a significant difference between the before and after stages of the intervention, while the IAH group showed a significant difference between the during and after stages of the intervention. Overall, it is concluded that the KC group experienced more time in deep sleep for the duration of the intervention than the IAH group did (Bastani et al., 2017). The limitation to this study was that the sleep states were measured by real-time observation, as video recorders were not culturally accepted. This limitation prevented the ability of researchers to ensure accurate records and review footage from the study. Strengths to this study were that the intervention was very well described and the data correlated with previous studies, while creating new suggestions for further research. In total, the KC intervention has been proven to significantly magnify the favorable states of deep sleep and quiet awake/alert, while significantly decreasing the unfavorable states of light sleep, drowsiness, and actively awake (Bastani et al., 2017).

Intervention of Kangaroo Care for Breastfeeding

Hake-Brooks & Anderson (2008), conducted a randomized controlled trial to determine the effects of kangaroo care (KC) on the status of postpartum breastfeeding in mother-preterm dyads through 18 months postpartum. The study included a subsample of 66 mother-infant dyads (Hake-Brooks & Anderson, 2008). Inclusion criteria for infants were that they had to be born

between 32-36 completed weeks gestation, have a birth weight of 1,300-3,000 g, and have a 5 minutes Apgar score equal or greater than 6. Mothers had to be English speaking, 18 years or older, experiencing a singleton birth, and healthy enough to perform the kangaroo care. Studies took place at the University Hospitals of Cleveland and Kadlec Medical Center in Washington (Hake-Brooks & Anderson, 2008).

Mother-infant dyads were randomly assigned using the computerized minimization method to be in either the KC group, or the control group whom received standard care (Hake-Brooks & Anderson, 2008). Final results comprised of 36 dyads assigned to the KC group, and 30 dyads assigned to the control group. Every mother indicated an intention to breastfeed. There was an in-hospital phase that lasted for five days or until the infant was discharged. Following the in-hospital phase were follow-up assessments performed by telephone at six weeks and three months, and follow-up interviews at clinic at six, twelve, and eighteen months. Mothers in the intervention group were encouraged to start KC as soon as possible after birth, as well as often and long as possible. KC was defined was skin-to-skin contact, chest to chest between the mother's breasts wearing a diaper and hat, as well as covered across the back with a blanket. Status of breastfeeding was determined using the Index of Breastfeeding Status (IBS) which is used to precisely and consistently define breastfeeding status. During hospitalization, data was collected on the number of breast feedings, amount of formula received, and amount of expressed breast milk fed (Hake-Brooks & Anderson, 2008).

Length of kangaroo care utilization was recorded using a contact log and the Index of Mother-Infant Separation tool (Hake-Brooks & Anderson, 2008). Mean KC per day was found to be 4.47 ± 3.07 hours. Results found that KC dyads had a higher level of breastfeeding exclusivity at all six time points, as well as a higher percentage of dyads at full exclusivity in the first four of

the six time points. Hake-Brooks & Anderson (2008), also found "More KC dyads were breastfeeding at full exclusivity at discharge (72 percent vs 60 percent), six weeks (33 percent vs 17 percent), three months (19 percent vs 3 percent), and six months (8 percent vs 0 percent)" (p.156). There were no dyads exclusively breastfeeding at 12 or 18 months. The study also found that KC dyads breastfed significantly longer than the control days, with an average of 5.08 ± 5.48 months vs 2.05 ± 2.15 months. A greater variability in duration was also shown with two KC days still breastfeeding at 18 months, and no control dyads breastfeeding past seven months. Possible limitations of the study include the fact that follow-up data was based on self-report by the mothers and mothers knew what group they were in. Strengths of the study were that the computerized minimization method was used to randomize subjects and the use of IBS established a precise definition of breastfeeding. Further research is implicated to determine specific amount of timing for the use of KC that would ensure success. Overall, it was concluded that KC positively increases exclusivity and duration of breastfeeding in preterm infants (Hake-Brooks & Anderson, 2008).

Oras et al. (2015), designed a prospective longitudinal study that explored at how skin-to-skin contact affected the initiation of breastfeeding, duration of breastfeeding, and growth size in preterm infants in a Swedish NICU There was a total of 104 preterm infants with a gestational age of "28 + 0 to 33 + 6" that were followed for a total of one year (Oras et al., 2015, p. 784). There were two cohorts that were split up among two NICU's (A and B) in Sweden. At the beginning of the study, infants in NICU A were fed every two hours, and infants in NICU B were fed every three hours. Initially both groups were fed with the donor milk, but slowly replaced it with the mother's milk over time. Data about the amount of time infants would spend performing skin-to-skin contact was documented by staff or parents. Their consistency was

evaluated as having a high compliance. Determining weight before and after feeding was measured by weighing on a scale. The infants' growth was measured by their weight, length, and head circumference. Time considered "full breastfeeding" was recorded by the staff in the NICU's, and was defined as the time when the infant started feeding off of only the breast milk from the breast (Oras et al., 2015).

Results showed that nutritive sucking was observed and "a measurable milk intake verified at a median range of 33 + 6 weeks and days (30 + 6 to 36 + 5) of postmenstrual age (n=80)" (Oras et al., 2015, p. 786). Only 53 infants reached the level of exclusive breastfeeding by the end of the study, with the median time being 35 weeks post-birth. The median time of exclusive duration amongst the infants was five months. The median time each day that the infants spent with skin-to-skin contact was seven hours and 30 minutes. The daily amount of time spent with skin-to-skin contact did not correlate with the total time spent in exclusive or partial breastfeeding. There was not an association with the length of skin-to-skin contact and weight loss or growth. Kangaroo care has also been shown to be associated with a higher prevalence in breastfeeding than conventional care (Oras et al., 2015). A weakness to this study was the possibility of inaccuracy in data collection, due to the fact that parents and staff recorded the data. Other measurements like growth are also questionable in consistency and validity due to different people measuring it with different equipment. Strengths included the large sample size and length of the study. Overall, the major clinically significant finding in this study was that skin-to-skin contact confirms that it is possible to reach exclusive breastfeeding before 32 weeks gestational age, when previously believed that it was unattainable before 34 weeks (Oras et al., 2015). A longer duration of skin-to-skin contact was also proven to be associated with earlier attainment of exclusive breastfeeding.

Conclusion

According to these studies, kangaroo care can be a very beneficial intervention to both preterm infants and their parents. KC has been shown in these articles to be a non-invasive, non-pharmacologic intervention, that is both cost efficient and easy to educate nurses and parents on. There were several beneficial outcomes evaluated in these research articles. According to Bastani et al. (2017), infants in the NICU rarely reach deep sleep and quiet awake states which are required for healthy development. These sleep states are related to healthy brain maturation and reflect central well-being of the nervous system (Bastani et al., 2017). Deep sleep also reduces tension and stress in infants, as well as enhances the delivery of oxygen to their tissues. The use of kangaroo care to significantly increase premature infants' time spent in deep sleep has been supported by Bastani et al. (2017). Breastfeeding has been shown to improve developmental outcomes by: lowering rates of retinopathy of prematurity, decreasing hospital stay length, decreasing risk and severity of infections, and promoting cognitive and motor development (Hake-Brooks & Anderson, 2008). Effects that KC has on breastfeeding included: longer durations, high levels of exclusivity (Hake-Brooks & Anderson, 2008) and earlier attainment of exclusivity (Oras et al., 2016). Through breastfeeding, KC has been shown to reduce the risk of nosocomial infections, as the mother is exposed to NICU pathogens and is thus able to produce antibodies in her breastmilk (Hake-Brooks & Anderson, 2008). Overall, prematurity presents many barriers to breastfeeding such as maternal concern, difficulty transporting to the NICU, and delaying initiation; however, these can be overcome with the help of kangaroo care (Hake-Brooks & Anderson, 2008). Pre-term infants in the NICU undergo an average of two to three invasive procedures a day, heel pricks being the most common (Nimbalkar et al., 2013). Kangaroo care has been shown to be statistically significant in reducing

pain during heel sticks by double, even in short durations (Nimbalkar et al., 2013). Along with painful procedures, infants often experience many other non-painful, but stressful situations in the NICU. These stressful experiences are often associated with an increased risk of intraventricular hemorrhage, increased oxygen consumption, hypertension, and increased stress hormones (Lyngstad et al., 2014). Stress hormones like cortisol are shown to have adverse effects on cognition and memory, impaired growth, and delay overall development. Lyngstad et al. (2014), found that kangaroo care was effective in reducing infants' stress in diaper changes, which occur several times per day. This finding is clinically significant, as it may indicate that kangaroo care can be effective in reducing stress in other stressful interventions, thus reducing related consequences (Lyngstad et al., 2014). KC showed positive effects not only for the infants, but for the mothers. It was shown to increase infant-maternal attachment levels, as well as decrease maternal stress (Cho et al., 2016) and anxiety (Arnon et al., 2014).

Further research may be done to combine some of these results and research questions to conclude if there are additional benefits to kangaroo care in preterm infants. In closing, clinical implications reveal that "kangaroo care may be one of the most effective nursing interventions in the neonatal intensive care unit for the care of preterm infants and their mothers" (Cho et al., 2016, p. 430).

CHAPTER 3

Best Practice Recommendation: Support Kangaroo Care in Preterm Infants in the NICU

The purpose of this thesis was to create evidence-based, best practice recommendations to support the use of kangaroo care in preterm infants in the NICU. As shown in Table 1, this chapter presents the proposed best practice recommendations to assist parents and nurses when providing kangaroo care to preterm infants.

Table 1

Best Practice Recommendations for Kangaroo Care in Preterm Infants in the NICU

Recommendation	Rationale	References	Level of Evidence
Infant to wear only a diaper during kangaroo care	• The infant only wearing a diaper during kangaroo care contributed to longer periods of deep sleep, and less time in light or drowsy sleep.	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi: 10.1097/JNR.0000000000000194	Level II
	• The infant only wearing a diaper during kangaroo care contributed to the increase in breastfeeding exclusivity and duration.	Hake-Brooks, S. J. & Anderson, G. C. (2008). Kangaroo care and breastfeeding of mother-preterm infant dayads 0-18 months: A randomized, controlled trial. *Neonatal Network, 27*(3), 151-159. doi: 10.1891/0730-0832.27.3.151	Level II
	• The infant only wearing a diaper during kangaroo care contributed to reduction in stress and decrease in pain during minor painful procedures like a heel stick.	Nimbalkar, S. M., Chaudhary, N. S., Gadhavi, K. V., & Phatak, A. (2013). Kangaroo mother care in reducing pain in preterm neonates on heel prick. *Indian Journal of Pediatrics, 80*(1), 6-10. doi: 10.1007/s12098-012-0760-6	Level II
Infant placed upright and prone on mother's bare chest, near her heart during	• The placement of the infant prone on the mother's chest, near her heart during kangaroo care contributed to longer	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi:10.1097/JNR.0000000000000194	Level II

kangaroo care	periods of deep sleep, and less time in light or drowsy sleep.		
	• The placement of the infant in a vertical position on the mother's bare chest contributed to the stabilization of physiological function in premature infants.	Cho, E. S., Kim, S. J., Myung, S. K., Cho, H., Kim, E. H., Jun, E. M., & Lee, S. (2016). The effects of kangaroo care in the neonatal intensive care unit on the physiological functions of preterm infants, maternal-infant attachment, and maternal stress. *Journal of Pediatric Nursing, 31*(4), 430-438. doi: 10.1016/j.pedn.2016.02.007	Level III
	• The placement of the infant prone, chest to chest, between the mother's breasts contributed to the increase of breastfeeding exclusivity and duration.	Hake-Brooks, S. J. & Anderson, G. C. (2008). Kangaroo care and breastfeeding of mother-preterm infant dayads 0-18 months: A randomized, controlled trial. *Neonatal Network, 27*(3), 151-159. doi: 10.1891/0730-0832.27.3.151	Level II
	• The placement of the infant prone, chest to chest, between the mother's breasts contributed to the decrease in bradycardia and desaturation events	Mitchell, A. J., Yates, C. Williams, K., & Hall, R. W. (2013). Effects of daily kangaroo care on cardiorespiratory parameters in preterm infants. *Journal of Neonatal Perinatal Medicine, 6*(3), 243-249. doi: 10.3233/NPM-1370513	Level II
	• The placement of the infant prone on their mother's bare chest, between her breasts during kangaroo care contributed to a reduction in stress and a decrease in pain during minor painful procedures like a heel stick.	Nimbalkar, S. M., Chaudhary, N. S., Gadhavi, K. V., & Phatak, A. (2013). Kangaroo mother care in reducing pain in preterm neonates on heel prick. *Indian Journal of Pediatrics, 80*(1), 6-10. doi: 10.1007/s12098-012-0760-6	Level II
Use of a soft blanket wrapped around infant and mother during kangaroo care	• The use of a blanket across the infant's back during kangaroo care contributed to an increase in autonomic stability in preterm infants.	Arnon, S., Diamant, C., Bauer, S., Regev, R., Sirota, G., & Litmanovitz, Ita. (2014). Maternal singing during kangaroo care led to autonomic stability in preterm infants and reduced maternal anxiety. *Acta Paediatrica, 103*, 1039-1044. doi: 10.1111/apa.12744	Level II
	• The use of a blanket during kangaroo care contributed to longer periods of deep	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm	

	sleep, and less time in light or drowsy sleep.	infants. *The Journal of Nursing Research, 25*(3), 231-239. doi:10.1097/JNR.0000000000000194	Level II
	• The use of a blanket covering the infant's back during kangaroo care contributed to the increase in breastfeeding exclusivity and duration.	Hake-Brooks, S. J. & Anderson, G. C. (2008). Kangaroo care and breastfeeding of mother-preterm infant dayads 0-18 months: A randomized, controlled trial. *Neonatal Network, 27*(3), 151-159. doi: 10.1891/0730-0832.27.3.151	Level II
	• The use of a blanket covering the infant's back during kangaroo care contributed to decrease in bradycardia and desaturation events	Mitchell, A. J., Yates, C. Williams, K., & Hall, R. W. (2013). Effects of daily kangaroo care on cardiorespiratory parameters in preterm infants. *Journal of Neonatal Perinatal Medicine, 6*(3), 243-249. doi: 10.3233/NPM-1370513	Level II
	• The use of a blanket placed around infant's back contributed to the decrease in pain for pre-term infants during heel sticks.	Nimbalkar, S. M., Chaudhary, N. S., Gadhavi, K. V., & Phatak, A. (2013). Kangaroo mother care in reducing pain in preterm neonates on heel prick. *Indian Journal of Pediatrics*, *80*(1), 6-10. doi: 10.1007/s12098-012-0760-6	Level II
Perform kangaroo care for a minimum of one hour per session if possible	• A minimum of 60 minutes is required for kangaroo care to positively affect a preterm infant's sleep-wake cycles.	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi:10.1097/JNR.0000000000000194	Level II
	• A minimum of one hour of kangaroo care has been associated with improved infant outcomes, more organized sleep-wake cycles, and creation of long lasting benefits.	Campbell-Yeo, M. L., Disher, T. C., Benoit, B. L., & Johnston, C. C. (2015). Understanding kangaroo care and its benefits to preterm infants. *Pediatric Health, Medicine and Therapeutics, 6,* 15-32. doi: https://doi.org/10.2147/PHMT.S51869	Level I
		Nyqvist, K. H., Anderson, G. C., Bergman, N., Cattaneo, A., Charpak, N., Davanzo, R., . . . Widstrom, A. M. (2010). Towards universal Kangaroo Mother Care: Recommendations and report from the first European conference and seventh international	Level VII

		workshop on kangaroo mother care. *Acta Paediatrica, 99,* 820-826. doi: 10.1111/j.1651-2227.2010.01787.x	
Minimize light and sound levels during kangaroo care	• Kangaroo care during the afternoon was beneficial as most NICU's are typically quieter with more muted lights. There is also fewer interruptions from nursing interventions. Minimizing light and noise during kangaroo care positively affected preterm infant's sleep and wake cycles. • The use of privacy and minimization of outside noise contributed to the stabilization of physiological function in premature infants. • The minimization of light and sound during kangaroo care contributed to a decrease in stress during non-painful procedures like diaper changes.	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi:10.1097/JNR.0000000000000194 Cho, E. S., Kim, S. J., Myung, S. K., Cho, H., Kim, E. H., Jun, E. M., & Lee, S. (2016). The effects of kangaroo care in the neonatal intensive care unit on the physiological functions of preterm infants, maternal-infant attachment, and maternal stress. *Journal of Pediatric Nursing, 31*(4), 430-438. doi: 10.1016/j.pedn.2016.02.007 Lyngstad, L. T., Tandberg, B. S., Storm, H., Ekeberg, B. L., & Moen, A. (2014). Does skin-to-skin contact reduce stress during diaper change in preterm infants? *Early Human Development, 90,* 169-172. doi: 10.1016/j.earlhumdev.2014.01.011	Level II Level III Level II
Promote use of mother's comforting voice during kangaroo care	• The use of comforting, maternal singing (range of 50-65dB) while performing kangaroo care contributed to an increase in autonomic stability in preterm infants. • The use of a mother's comforting voice during kangaroo care contributed to a decrease in stress during non-painful procedures like diaper changes.	Arnon, S., Diamant, C., Bauer, S., Regev, R., Sirota, G., & Litmanovitz, Ita. (2014). Maternal singing during kangaroo care led to autonomic stability in preterm infants and reduced maternal anxiety. *Acta Paediatrica, 103,* 1039-1044. doi: 10.1111/apa.12744 Lyngstad, L. T., Tandberg, B. S., Storm, H., Ekeberg, B. L., & Moen, A. (2014). Does skin-to-skin contact reduce stress during diaper change in preterm infants? *Early Human Development, 90,* 169-172. doi: 10.1016/j.earlhumdev.2014.01.011	Level II Level II

Initiating kangaroo care within preterm infant's first week of life if clinically stable	• The initiation of kangaroo care within the first week of life showed a significant reduction in neonatal mortality.	Lawn, J. E., Mwansa-Kambafwile, J., Horta, B., Barros, F. C., & Cousens, S. (2010). 'Kangaroo mother care' to prevent neonatal deaths due to preterm birth complications. *International Journal of Epidemiology, 39,* i144-i154. doi: 10.1093/ije/dyq031	Level I
Provider of kangaroo care must have good hygiene and be free of noxious scents and debris	• Encouraging mothers to participate in good hygiene and abstain from using heavily scented lotions and perfumes will decrease noxious exposure and stimuli for the infant during kangaroo care.	Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi: 10.1097/JNR.0000000000000194 Cho, E. S., Kim, S. J., Myung, S. K., Cho, H., Kim, E. H., Jun, E. M., & Lee, S. (2016). The effects of kangaroo care in the neonatal intensive care unit on the physiological functions of preterm infants, maternal-infant attachment, and maternal stress. *Journal of Pediatric Nursing, 31*(4), 430-438. doi: 10.1016/j.pedn.2016.02.007	Level II Level III
Initiation of kangaroo care only in infants if clinically stable	• The majority of research studies have shown various positive effects and effectiveness of kangaroo care in preterm infants that are clinically stable. (exclusion criteria predicting clinical stability often correlated with 5 minute Apgar scores of ≥ 6 and absence of Grade III or IV intraventricular hemorrhages)	Arnon, S., Diamant, C., Bauer, S., Regev, R., Sirota, G., & Litmanovitz, Ita. (2014). Maternal singing during kangaroo care led to autonomic stability in preterm infants and reduced maternal anxiety. *Acta Paediatrica, 103,* 1039-1044. doi: 10.1111/apa.12744 Bastani, F., Rajai, N., Farst, Z., & Als, H. (2017). The effects of kangaroo care on the sleep and wake states of preterm infants. *The Journal of Nursing Research, 25*(3), 231-239. doi: 10.1097/JNR.0000000000000194 Carbasse, A., Kracher, S., Hausser, M., Langlet, C., Escande, B., Donato, L., . . . Kuhn, P. (2013). Safety and effectiveness of skin-to-skin contact in the NICU to support neurodevelopment in vulnerable preterm infants. *Journal of Perinatal & Neonatal Nursing, 27*(3),	Level II Level II Level II

	255-262. doi: 10.1097/JPN.0b013e31829dc349	
	Hake-Brooks, S. J. & Anderson, G. C. (2008). Kangaroo care and breastfeeding of mother-preterm infant dayads 0-18 months: A randomized, controlled trial. *Neonatal Network, 27*(3), 151-159. doi: 10.1891/0730-0832.27.3.151	Level II
	Lawn, J. E., Mwansa-Kambafwile, J., Horta, B., Barros, F. C., & Cousens, S. (2010). 'Kangaroo mother care' to prevent neonatal deaths due to preterm birth complications. *International Journal of Epidemiology, 39,* i144-i154. doi: 10.1093/ije/dyq031	Level I
	Lyngstad, L. T., Tandberg, B. S., Storm, H., Ekeberg, B. L., & Moen, A. (2014). Does skin-to-skin contact reduce stress during diaper change in preterm infants? *Early Human Development, 90,* 169-172. doi: 10.1016/j.earlhumdev.2014.01.011	Level II
	Mitchell, A. J., Yates, C. Williams, K., & Hall, R. W. (2013). Effects of daily kangaroo care on cardiorespiratory parameters in preterm infants. *Journal of Neonatal Perinatal Medicine, 6*(3), 243-249. doi: 10.3233/NPM-1370513	Level II
	Nimbalkar, S. M., Chaudhary, N. S., Gadhavi, K. V., & Phatak, A. (2013). Kangaroo mother care in reducing pain in preterm neonates on heel prick. *Indian Journal of Pediatrics, 80*(1), 6-10. doi: 10.1007/s12098-012-0760-6	Level II

Summary of Best Practice Recommendations

The literature review in the previous chapter summarized the multiple benefits that kangaroo care can have on preterm infant. Each evidence-based research article presented slight

variations on the implementation of kangaroo care. The most attainable and realistic interventions were considered when writing the best practice recommendations. The effectiveness of each interventions was also considered when writing recommendations. Recommendations encompassed inclusion and exclusion criteria of infants, as well as criteria necessary during actual implementation of care; thus, targeting recommendations for both providers of care and infants receiving care.

CHAPTER 4

Implementation and Evaluation

This chapter will focus on the implementation and evaluation of an educational bulletin board displayed in a local hospital's NICU waiting room during a kangaroo-a-thon. This chapter includes a discussion about strengths and weaknesses of the thesis, as well as an encompassing summary of the project in total. The model of implementation that was used will be based off of a translation model published by Johns Hopkins Nursing (Dearholt & Dang, 2012). The translation model involves the transfer of recommendations from the thesis into the clinical setting. The model outlines the transfer through use of implementation, evaluation, and communication. The initial phase of the model will go into detail about the creation of an implementation plan and how resources were secured for the plan. The second phase of the model will discuss the actual implementation and communication of the plan. The third phase of the model will evaluate outcomes and processes. Finally, the last phase will involve the dissemination of outcomes to decision makers.

Securement of Resources

Support

A meeting was conducted with the local hospital's NICU developmental specialist to discuss goals and plans for the implementation of a kangaroo-a-thon and educational board. This meeting led to a subsequent meeting for approval regarding specific information to be displayed on the bulletin board. Financial support was also gained from the University of Arizona's Honors College, through a scholarship that supported thesis'. This scholarship was beneficial in providing funding for supplies and use for additional incentives for participating in the event.

Following the approval of information and resources, support was secured and implementation was able to proceed.

Implementation Plan

The overarching purpose of the kangaroo-a-thon competition was to promote the utilization of kangaroo care in the NICU setting. The event was designed to occur from May 8th to May 29th, in effort to occur during International Kangaroo Care Day on May 15th. This particular kangaroo-a-thon had been designed to be a separate competition amongst parents and nurses. Parents competed against parents, while nurses competed against fellow nurses. The idea to implement an educational bulletin board was created to highlight evidence-based recommendations generated in this thesis. Information on the board also included the benefits of kangaroo care, as well as information necessary to safely and effectively initiate it. Through the process, it served as a source of information for parents and nurses who were providing kangaroo care throughout the duration of the event.

Implementation

Communicating Plan

The communication of the plan began with a meeting with the NICU developmental specialist. This meeting involved the proposal of a kangaroo-a-thon, as well as discussion of the bulletin board and its role in the event. Information discussed in the proposal, to be displayed on the bulletin board, was then approved by the hospital's NICU managers and leaders. Once information was approved, the process of informing staff began. The communication of implementation to staff began with mention of the event via email and verbal announcement during the nurse's huddle. An informational handout was also posted around the unit and in the

break room in aim to alert staff and patients of the upcoming event. Figure 1 is a copy of the handout that was posted around the unit.

Figure 1. An informational handout created by the author, to spread awareness of upcoming event.

Implementing an Educational Bulletin Board

Action Plan. This bulletin board was displayed at a local hospital's kangaroo-a-thon, where kangaroo care was performed daily over the course of three weeks. The leader responsible for the board was the author of this thesis. This was the first time that these specific recommendations created through this thesis were emphasized in this particular NICU. The bulletin board was used as a reference for parents and nurses to use if they chose to participate in the kangaroo care competition. It was also beneficial in initiating the topic and introducing potentially new information to parents who had not yet heard or learned about kangaroo care. The overall goal of the bulletin board was to increase the parent's knowledge and confidence in providing kangaroo care for their preterm infants. The bulletin board was developmentally appropriate, ensuring a high probability of understanding and comprehension. The board's

contents was guided by the information recovered during the literature review and was based on evidence-based data, outlined in chapter two and three of this thesis.

Construction. Construction began with creating a plan for the assembly of the educational bulletin board. The size of the board was first visualized to dictate how much room was available to include information. The board was both visually appealing and designed at a developmentally appropriate level to allow for easy understanding for both parents and nurses. Pictures, diagrams, and text were all included in the board to allow for education that utilized different types of learning styles. The information included was both relevant and important for parents and nurses to be familiar with, prior to performing kangaroo care. The following information about kangaroo care was included: background information, proper positioning, various benefits, and information about National Kangaroo Care Awareness Day. Most importantly, the bulletin board highlighted the evidence-based recommendations outlined in chapter three of this thesis. All of the paper was laminated in accordance to infection prevention policies, and then taped to the board and surrounding wall. Figure 2 is a photo taken of the finished bulletin board displayed in the waiting room of the NICU.

Figure 2. A photo of the bulletin board, on display in the waiting room of the hospital's NICU.

Summary. The ultimate goal of the educational bulletin board was to assist with the delivery of vital information and recommendations to possible or current participants in the kangaroo-a-thon. The targeted audience included parents and family members of NICU patients, as well as nurses. The expected outcome was that kangaroo care would be more widely used and understood throughout the hospital and community surrounding NICU infants. Overall, it was intended that the awareness and knowledge of kangaroo care would increase, thus more infants would benefit.

Evaluation

Measuring Outcomes

The evaluation of the effectiveness of the educational bulletin board happened in conjunction with the local kangaroo-a-thon. Due to the fact that the bulletin board was displayed for the entire course of the kangaroo-a-thon, evaluation was to be determined based on the amount of kangaroo care "ballots" received at the end of the event. The kangaroo-a-thon had a total duration of approximately three weeks, ranging approximately from May 8th to May 29th. The number of ballots represented the number of successful times a parent and nurse completed kangaroo care with a preterm infant. It was assumed that successful completion of kangaroo care coincided with successful understanding of information relayed to the parents and nurses via the educational bulletin board.

At the conclusion of the kangaroo-a-thon, the total number of ballots were counted. There were a total of 126 ballots accounted for, with participation from 33 different preterm infants. However, it is pertinent to mention that some parents reported performing kangaroo care without

re-entering an additional ballot. This suggests that actual participation may have been higher than the amount of ballots accounted for.

Evaluation of Processes

The effectiveness of the educational bulletin board in the event was evaluated based on parent's successful participation in the kangaroo-a-thon. Successful participation in the event was equated to one ballot per session of kangaroo care. In conjunction with the kangaroo-a-thon, it was proposed to evaluate effectiveness of education and the encouragement of implementation through the use of a pre- and post-survey taken by the parents before and after reading the board. Figure 3 is an example of the survey to be used during pre- and post-survey.

Figure 3

	Kangaroo Care Survey	**Strongly Disagree**			**Strongly Agree**	
	Question	**1**	**2**	**3**	**4**	**5**
1	I feel confident in providing kangaroo care to my infant.					
2	I feel safe providing kangaroo care to my infant.					
3	I am knowledgeable in kangaroo care in preterm infants.					
4	I feel confident in teaching others about how to perform kangaroo care in preterm infants.					

The results of the surveys would be evaluated utilizing a Likert scale format. However, due to limitations, actual evaluation was only measured through a post-kangaroo-a-thon ballot count.

Dissemination of Outcomes

As previously discussed, at the conclusion of the kangaroo-a-thon, outcomes were measured through the counting of ballots. This data was then reported to the leaders of the unit

and hospital. Information was then available to be used as a baseline for future kangaroo-a-thons to use for comparison. Information gathered can now be used to build upon for future improvement and success in the implementation of kangaroo care in NICU's.

Strengths and Limitations of Thesis Project

The primary strength in this thesis project was the overall conclusion that education provided to parents and nurses in the NICU setting about kangaroo care is effective in promoting this intervention. Evidence supports that kangaroo care is a safe, non-pharmacological intervention to decrease health risks in preterm infants in NICU's. This evidence was incorporated into the development of the educational board in the event's NICU. Findings in the articles were also consistent with findings in previous literature, including systematic reviews, that were outside of this thesis' search dates. An additional strength was that the thesis incorporated a wide variety of articles proving several different benefits related to kangaroo care. Demographics were often equal, and interventions were often proved to be generalizable to the NICU population.

Limitations of the thesis project included the variation in implementation time and procedure of kangaroo care. There were dissimilarities when it came to the recommended time of implementation for kangaroo care to be effective in each article. Research also focused on mothers as the providers of kangaroo care, making administration less generalizable for those who are not maternal relatives.

Summary of Thesis Project

Kangaroo care has been extensively researched with countless instances of favorable outcomes. The success of this kangaroo-a-thon builds upon past literature and has implications future utilization and education regarding kangaroo care in NICU's. Success of the

implementation of the educational bulletin board will further promote the specific evidence-based recommendations outline in this thesis. The goal of these recommendations and kangaroo-a-thon are to promote and guide the widespread use of kangaroo care in NICU's when clinically safe. Proper use of kangaroo care has been proven to aid in "infant's warming, comfort, physiological and behavioural stabilization, sleep, growth, neuro-development and psychological benefits" (Nyqvist et al., 2010, p. 823). In conclusion, kangaroo care is an evidence-based, safe, non-invasive, and cost-efficient intervention that should be performed in all eligible preterm infants. The recommendations in this thesis should be utilized to promote effective and safe kangaroo care for preterm infants in the NICU, with the overall goal to achieve the numerous benefits that have been continually demonstrated in research.

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Appendix

Table 1

Table of Evidence: The Effects of Kangaroo Care on Preterm Infants

Author(s) and Date	Questions, variables Objectives, hypothesis	Design, sample, setting	Findings	Notes
Nimbalkar et al., 2013	- kangaroo mother care in small duration effect on decreasing pain in preterm infants during painful procedures like heel pricks - kangaroo mother care groups vs. control group	- randomized controlled double masked crossover trial - NICU in Karamsad, India - 50 neonates with gestational age between 32-36 weeks - used kangaroo positioning 15 minute prior to heel prick, during, and after (60°, between the mother's breasts, with a blanket placed over the infant's back) - control group in prone position, swaddled in blanket 15 minutes prior to heel prick - assessed through the Premature Infant Pain Profile (PIPP)	1. PIPP score for kangaroo care group was 5.38 2. PIPP score for control group with no intervention was 10.23 3. in intervention group: heart rates were lower and facial actions and behaviors were better 4. kangaroo care is a cost effective, non-pharmacologic intervention to decrease pain in preterm infants 5. difference between groups was significant	- only had full data from 47 babies, 3 babies had missing data - PIPP measured heart rate, oxygen saturation, behavior, brow bulge, eyes squeezed shut, nasolabial furrow, and gestational age - every one of the infants in the kangaroo care group had lower PIPP scores than infants in the control group - results consistent with other research
Lyngstad et al., 2014	- investigated if diaper changes caused stress in preterm infants - determined whether skin-to-skin care decreased the stress of diaper changes	- randomized crossover pilot study - 19 preterm infants with gestational age of 28-34 weeks - Drammen Hospital NICU in Norway - stress measured by MED-Storm's Skin Conductance Algesimeter monitors - control group set in incubator or bed and positioned side wise while mother held hands on head and body and soothed with voice - skin-to-skin group put in lateral kangaroo position with mother's hands on head and body while comforting in soothing voice	1. diaper changes are in fact a stressful event in preterm infants 2. increase in SC peaks/sec from before to during procedure 3. lower number of peaks in skin-to-skin group during diaper changes (mean paired difference -0.089, 95% CI -0.168 to -0.011, $p = 0.028$) 4. -significant decrease in stress in infants with skin-to-skin care	- electrodes placed on infants' feet, thus non-invasive study - stress measured by heart rate, oxygenation saturation - changes in SC peaks/sec show evidence of emotional sweating and are mediated through cholinergic muscarinic receptors
Cho et al., 2016	- determine effects of kangaroo care on physiological function - determine effect of kangaroo care on maternal-infant attachment - determine how kangaroo care effects maternal stress - preterm infants	- quasi-experimental design - Seoul, Korea general hospital - non-random assignment to control or experimental group - gestational age at or above 33 weeks within preterm range - small sample size (40 infants) - physiological effects measured: weight, heart rate, respiration rate, oxygenation saturation, body temperature - questionnaire for maternal-infant attachment - Parental Stress Scale questionnaire - kangaroo care performed 3 times a week for total of 10 times, in 30 minute sessions (60° vertical position)	1. respiration rate between groups was significantly different ($F = 5.70$, $p = .020$) 2. respiration rate in kangaroo group was significantly lower than control group (contributes to stability) 3. increase in maternal-infant attachment ($F = 28.881$, $p < .001$) 4. maternal stress was reduced ($F = 47.320$, $p < .001$)	- nurses who collected data had at least 10 years clinical experience and were intermittently observed for consistency - results congruent with previous studies - positive effects of kangaroo care on stabilizing infants' breathing and had favorable effects on mothers
Carbasse et al., 2013	- determine safety and effectiveness of kangaroo care in vulnerable	- prospective observational study - 96 vulnerable preterm infants - NICU in University Hospital of Strasbourg - average gestational age of 28	1. significant decrease in heart rate with kangaroo care 2. significant decrease in oxygen requirements 3. significant increase in oxygen	- was no way to rule out selection bias due to being an observational study - cannot rule out effect of subjective reporting on

	preterm infants - investigate effects of kangaroo care	months, average weight of 1070 g - infants continuously monitored and measured 5 different times (1 pre-intervention, 3 during intervention, 1 post-intervention) - intervention was infants placed in diaper in kangaroo position on mother and covered in blanket	saturation 4. significant decrease in axillary temperature after infant transferred from bed to mother 5. kangaroo care as safe and effective in vulnerable infants as it is in more stable preterm infants 6. skin-to-skin contact is safe and effective for vulnerable preterm infants and can improve neurodevelopment	outcome sof physiological data - physiological stability related to neurodevelopment
Bastani et al., 2017	- compared in-arms-holding and kangaroo care on levels of sleep and wake states in preterm infants	- randomized controlled trial - 72 infants randomly assigned to IAH group or KC group in - NICU in Tehran, Iran - pre-intervention phase, intervention phase, post-intervention phase - intervention consisted of KC group infants placed on mother's bare chests wearing diaper at diagonal angle (lasted 70 minutes) - physiological parameters monitored throughout whole study	1. deep sleep in KC group increased to 23.08 ± 4.22 2. deep sleep in IAH group increased to 5.31 ± 5.88 3. both groups increased deep sleep time but KC increased more than IAH 4. significant changes between two groups (F = 184.05, p = .001) 5. IAH group experienced more time in light sleep, drowsy state (p < .001), and the actively awake state (p = .02)	- Newborn Individualized Developmental Care and Assessment Program sleep and wake states: deep sleep, light sleep, drowsy, quietly awake and/or alert, actively awake and arouse, highly aroused and agitated/crying - observation measured by real time, not video - correlates with previous studies
Oras et al., 2015	- how skin-to-skin contact affects initiation of breastfeeding - how skin-to-skin affects duration of breastfeeding - how skin-to-skin affects growth size - preterm infants	- prospective longitudinal study - NICU in Sweden - 104 preterm infants with gestational age 28 + 0 to 33 + 6 - followed for one whole year - two cohorts, two NICU's - data recorded by parents or staff - growth measured by weight, length, head circumference	1. Nutritive suckling observed at median range of 33 + 6 weeks and days (30 + 6 to 36 + 5) of postmenstrual age (n=80) 2. Only 53 infants reached exclusive breastfeeding by end of year 3. Median time of exclusive breastfeeding 5 months 4. No association with length of skin-to-skin on weight growth or loss 5. Able to reach exclusive breastfeeding by 32 weeks	- median time of infants spent on skin-to-skin contact was 7 hours and 30 minutes - previously believed that exclusive breastfeeding could not be achieved before 34 weeks
Lawn et al., 2010	- estimated the effect of kangaroo care on preterm neonatal mortality - looked at associated morbidities related to preterm birth	- meta-analysis - 15 studies included, 9 were RCT's and 6 were observational studies - used the search engines: Cochrane Libraries, PubMed, LILACS < African Medicus, EMRO, and WHO regional databases	1. analysis found that KMC was associated with a major reduction in neonatal deaths for infants 2. KMC was also associated with reduction in serious morbidity 3. authors recommend routine use of KMC in clinics with stable babies weighing at least 2000g	- studies were all of moderate or high quality - results are similar to another meta-analysis showing that there was a reduction in neonatal mortality in babies weighing less than 2000g - authors stated that up to half a million deaths d/t preterm birth could be prevented using KMC
Arnon et al., 2014	- investigated the effects of maternal singing in conjunction with kangaroo care - looked at the effects of maternal singing during kangaroo care on autonomic stability - looked at the effect on maternal anxiety	- prospective randomized, within-subject, crossover, repeated measures study - Meir Medical Center, Kfar Saba, Israel from Oct 2011-March 2012 - 86 mother-infant dyads - infants were 32-36 weeks gestation - each session started 30 min after feeding, starting with 10 in of KC alone, followed by either KC alone or KC plus maternal singing for 20 min, sessions ended with 10 min of KC alone	1. compared to KC by itself, KC with maternal live singing caused a significantly beneficial decrease in maternal anxiety: 56.2 ± 10.8 before and 42.8 ± 8 after KC alone (p = 0.09) vs 50.6 ± 12.3 before and 26.4 ± 8.2 after KC with singing (p = 0.04) 2. LF/HF ratio was lower during KC and singing and recovery phases than KC by itself (p = 0.04). The ratio was also significantly lower during singing and recovery phases when compared to the baseline (p = 0.0 and p = 0.01).	- mother was sitting in chair, reclining at 40 degree angle - Infant prone, upright, with blanket over back - singing at 60-70 dB - environmental sounds did not exceed 45 dB - singing in repetitive, soothing tone, softly, simply, with slow tempo

	as well		3. no statistical or clinical differences in heart rate, oxygen saturation, and respiratory rate in any of the study phases	
Teckenberg-Jansson et al., 2011	- wanted to determine influence of music therapy combined with KC (DT) on physiological responses vs influence of KC alone - looked at parents' experiences of the effects of DT on their infants	- 61 stable infants born at 24-36 weeks' gestation - Helsinki University Central Hospital, Finland - parents given questionnaire with open ended questions - all infants were within +- 200g and +- 7 days for control pairs - first measurements done 10 min to 2 hours before therapy, then 10 minutes after starting therapy, and then 10 min to 2 hours before ending therapy - Therapy was 3 days a week	1. there was a significant effect on decreasing pulse, with an overall general decrease across therapy sessions 2. DT caused an overall decrease in RR 3. results showed an increase of transcutaneous oxygen saturation 4. during DT, parents were calm and content with care 5. no significant difference in growth and length of stay on the ward when using DT 6. positive effects increased with number of therapy sessions 7. combining music therapy with kangaroo care may have beneficial rapid effects on physiological measures compared with kangaroo care alone in premature infants	- median APGAR score was 6 at 1 min and 7 at 5 min - main problem in infants was intrauterine growth retardation, RDS, chronic lung disease, sepsis, and intraventricular hemorrhage - each infant received both music therapy and kangaroo therapy, as well as kangaroo therapy alone (control therapy) - 400 therapy sessions altogether included in analysis - music by trained music therapist - used lyre, female human voice - lack of randomization and lack of control group
Mitchell et al., 2013	- investigated effects of KC on cardiorespiratory parameters - study to compare bradycardia and desaturation events in infants in standard incubator care vs. KC	- randomized controlled trial - used on 38 infants 27-30 weeks gestational age - infants weighed at least 1000g - infants had to be clinically stable - mean gestational age was 20 weeks, all infants weight <1500g	1. significantly fewer bradycardia events (p=0.048) and oxygen desaturation events (p=0.017) for infants in KC group while being held 2. no changes in temperature stability, loss of IV access, feeding intolerance, or need for enhanced respiratory support during KC 3. no differences in infection rates between SC and KC	- started on DOL 5 and continuing for 5 days - mothers or fathers in KC group performed for 2 hours daily - infants in SC group could only be held maximum of 15 min/day - small sample size - some events may have been overlooked or misinterpreted because infants not constantly observed
Hake-Brooks et al., 2008	- aimed at determining effects of kangaroo care on breastfeeding	- randomized controlled trial - 66 maternal-infant dyads (30 control, 36 to KC) - infants were 32-36 GA - birth weight between 1,300 – 3,000 g - had 5 min APGAR equal to or greater than 6 - University hospitals of Cleveland in Cleveland, Ohio and Kadlec Medical Center in Richmond, Washington	1. KC dyads breastfed at higher levels of exclusivity at every time point, and also at a higher percentage of KC dyads at full exclusivity 2. more KC dyads were breastfeeding at full exclusivity at discharge (72% vs 60%), 6 weeks (33% vs 17%), 3 months (19% vs 3%), and 6 months (8% vs 0%) compared to control dyads 3. no dyads were breastfeeding at full exclusivity at either 12 or 18 months 4. KC dyads had greater variability in breastfeeding duration 5. KC positively influence exclusivity and duration of breastfeeding	- in hospital phase lasted 5 days or until infant discharged - follow up telephone assessments done at 6 weeks, 3 months, - follow up interview at 6, 12, and 18 months - over an 18 month period - Guatemalan study found damage to the gut was lowest with exclusive breastfeeding vs mixed or formula feeding